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PHARMACY'S UNFINISHED TASKS[1]

By Dr. ROBERT P. FISCHELIS

PRESIDENT OF THE AMERICAN PHARMACEUTICAL ASSOCIATION

THE preparation, standardization and dispensing of drugs and medicines constitute an activity which is indispensable to good medical care. How, where and under what conditions this professional activity can be carried on with greatest benefit to all concerned is a question that has been agitating many minds ever since the use of drugs in the treatment and prevention of disease became a part of the practice of medicine. It is not necessary to justify the existence of a separate group of practitioners to whom has been assigned the function of compounding and dispensing medicines. Pharmacists have made an important place for themselves among those engaged in providing good medical care to the people of all nations. The evidence of a changing attitude on the part of the public toward the organization of medical services, however, makes it advisable to examine, from time to time, our existing methods of furnishing pharmaceutical service and the systems by which such service is controlled.

The practice of medicine has been subjected recently to some searching inquiries on the part of professional and lay groups who are interested in providing medical care for all the people in fullest measure at a price they can pay. These inquiries have naturally included studies of pharmaceutical practice, and some interesting facts have been developed which should not be lost upon those most interested in the future welfare of the profession of pharmacy.

When we speak of pharmacists we do not necessarily limit ourselves to persons operating retail drug stores. As a matter of fact, a great deal of the practise of professional pharmacy is carried on to-day in places far removed from the corner drug store. The manufacturing function of the pharmacist, especially

[1] Part of an address delivered at the Third Annual Pharmaceutical Conference of the College of Pharmacy of the University of Michigan.

that which is carried on upon a large scale, has been transferred to a very great extent from the retail drug store to the laboratories of manufacturing houses. The ordinary retail drug store has become very largely a distributing center for manufactured products, although much small-scale manufacturing is still carried on in some retail drug stores, and nearly all of them engage in the extemporaneous compounding of prescriptions. Hospitals, medical centers, group clinics, manufacturing and research laboratories, as well as college classrooms and laboratories and governmental offices and laboratories, are other centers of activity in which pharmacists carry on their specialized function.

Recent surveys indicate that less than 10 per cent. of the retail drug stores of the United States carry on a sufficiently extensive prescription practise to maintain themselves economically, while the other 90 per cent., or more, although prepared and equipped to supply prescription service when, as and if needed, are able to do so only because their establishments are used to supply other services and commodities at a reasonable profit. In short, the public has cheerfully subsidized the professional services of the corner drug store for emergency needs by making it a source of supply for many related and unrelated commodities and non-professional services.

The drug store as a social institution has made a place for itself in every community. However, the profession itself has been unable to control the number of establishments seeking to supply pharmaceutical service, and no attempt has been made by our federal, state or local governments to regulate the supply of establishments organized to give pharmaceutical service. What is more, the attempt to regulate the quality of service has been rather limited. All states require some form of licensure of those who wish to qualify as pharmacists. Many states also have a licensing system which serves to control the establishment of pharmacies. However, the requirements for obtaining a license to operate a pharmacy offer no great hindrance to any one desiring to open such an establishment and carry on a business in drugs if registered pharmacists are employed. Hence the public control of the drug business leaves much to be desired.

Not only is there lack of uniformity in the licensing requirements for pharmacists and for the operation of pharmacies, but there is also, even in this enlightened day, considerable opposition to a strict legal control of the compounding and dispensing of drugs and medicines. Pharmacists by their training acquire a wholesome respect for the dangerous nature of the drugs and medicines with which they come in daily contact. This respect is not shared by the general public, if the attitude of many of our legislators is any criterion of public opinion.

The blame for this situation undoubtedly rests very largely with the profession itself. We have been entirely too careless in preserving our professional prerogatives. Little by little we have permitted the encroachment of unfriendly interests upon our domain. If such a situation were merely detrimental to the profession of pharmacy, it would be of only passing interest to the world at large.

Extent and Type of Service

We have, in the course of years, developed between fifty-five and sixty thousand "service stations" throughout the United States which are known to the average citizen as drug stores. We like to call them pharmacies because in our minds there is a distinction. The number of drug stores has developed consistently with the development of our national population. It has remained at a level of about one store per two thousand people for the last forty years, although the distribution is by no means as satisfactory as these figures imply. These "service stations" have endeavored to adjust themselves to the needs of the community in which they exist. We have the small country drug store serving rural communities, filling comparatively few prescriptions, because physicians in these districts carry their medicines, to a great extent, but stocking large numbers of ready-made medicines, "patent" medicines, home remedies, and also a great variety of unrelated merchandise. By virtue of the commerce in unrelated articles, this type of store is able to make a living and at the same time it is prepared to supply such professional services as may be called for when the occasion demands it.

We have also developed the neighborhood type of pharmacy in our larger communities and in metropolitan centers. Here the compounding of prescriptions and the dispensing of drugs and medicines is interspersed with a wide range of commercial activities, again for the purpose of maintaining the establishment so that its professional services may be available when needed. We have furthermore developed in some of these larger centers prescription pharmacies in which merchandising activities are reduced to a minimum. Such establishments are few in number. They furnish a marked contrast to the chain-store type of drug store in which high-pressure sales methods are applied to the distribution of ready-made medicines and general merchandise alike.

Undoubtedly there is a distinct need for the dramatization of the professional services rendered by the pharmacist. We may think the public is acquainted with the educational requirements for entrance into the profession of pharmacy, but the facts are that

Even members of the medical professions are not all familiar with the advances that have been made in the requirements for pharmaceutical licensure in recent years. If the professions do not know it, certainly the public is even more ignorant of the advances in pharmacy.

Twenty-five or more years ago, some of our pharmaceutical journals began to urge pharmacists to "get out of the rut" and give shelf space to fast-selling ready-made medicines, toilet articles or general merchandise, and relegate the ornate and impressively decorated shelf bottles and other containers to the rear or the basement of the store. There was a rush to follow this advice, and as time went on and the mysteriously labeled containers of tinctures, fluid extracts, chemicals, powders and crude drugs were removed from public gaze, the professional function of the pharmacist passed out of the public mind to a considerable degree. To-day, after twenty-five years or more of hiding the evidence of professional activity, a new crop of pharmaceutical editors is urging pharmacists to bring their prescription departments out into the open and rearrange their stores so that the public can see what goes on in the prescription room and laboratory of the store. Just as blindly as the advice to relegate all professional fixtures to the back room and cellar was followed years ago, so to-day many are following the advice to remove all privacy from the prescription room and let the public watch the pharmacist prepare the medicines they are going to take. It may be necessary to counteract the previous removal of all outward signs of professionalism from the front part of the drug store with the sudden exposure of the entire professional activity of the drug store to the public gaze, but it is to be hoped that a happy medium will soon be found which will settle us, for a time at least, somewhere between the extremes of commercial overdress and professional nudism.

Relation to Medicine

The practise of pharmacy is fundamentally a subdivision of the practise of medicine. The practise of medicine is essentially an art which involves the intelligent application of many sciences. In the practise of medicine, as in every other field of activity, there must be a division of labor. We, therefore, have the diagnostician, the surgeon, the internist and the many specialists who, although trained in general medicine, have chosen to devote their life activities to one branch of the practise of medicine and have become experts in their particular field. In addition to the practitioners of medicine, there is a vast army of medical scientists who may or may not be trained in the practise of medicine as a whole, but who have mastered one or more of the arts or sciences without which the practise of medicine would be severely handicapped. Under this heading come the pathologists, bacteriologists, roentgenologists, biochemists, pharmacists and others. Many of these medical scientists are trained in general medicine as well as in their own specialty. It is not rare, however, to find pathologists, roentgenologists and biochemists who are not doctors of medicine, and probably a majority of bacteriologists are not physicians. There are physicians who have specialized in the various branches of chemistry and in pharmacy, but by far the larger number of persons engaged in chemical and pharmaceutical work are not physicians.

If we look upon pharmacy as one of the specialized branches of the practise of medicine, we are, in a way, subordinating it to the practise of medicine as a whole. I see no disadvantage in this, although I am cognizant of attempts to look upon the practise of pharmacy as a separate entity. These attempts are, to my mind, undermining the solid foundation upon which professional pharmacy rests.

It is the function of pharmacy and the duty of the pharmacist, whether he plays the part of large or small-scale manufacturer, compounder or dispenser, to serve the physician and the public in the preparation, compounding and dispensing of therapeutic agents drawn from mineral, animal or vegetable sources. In the manufacturing laboratory, the pharmacist is a manufacturer. In the retail drug store he is a compounder and dispenser. In the research laboratory he may become the discoverer of new and better methods of administering drugs or he may devise new combinations of drugs or carry on important syntheses. These divided functions overlap at times, but they are becoming more and more distinct as time goes on. It is hardly conceivable that the need for extemporaneous prescription compounding will ever be eliminated. It is certain, however, that less and less manufacturing will be done by the prescription pharmacist, and that supplying simple and mixed pharmaceuticals in ready dosage forms, such as tablets, capsules, ampuls, etc., will increase to the point where extemporaneous compounding will be materially reduced.

Believing pharmacy's place in the art of medicine to be by its very nature auxiliary to medicine itself, it follows that there must be close cooperation with the medical profession if the dignity of the latter, as well as its high standing with the public, is to be reflected in the profession of pharmacy.

Three Fundamental Tasks

Underlying the continuance of a professional status for the pharmacist are three fundamental tasks, to the completion of which forward-looking members of the pharmacal profession long ago dedicated themselves:

(1) A program of education commensurate with the professional responsibilities to be assumed by the pharmacist.

(2) The advancement of legal and professional requirements for pharmaceutical licensure throughout the United States.

(3) The development of a professional solidarity among the practicing pharmacists of the United States for the furtherance of their scientific and economic objectives.

In the field of pharmaceutical education much has been accomplished, but much remains to be done. Shortly after it was decided that the minimum course in pharmacy should be raised to the level of the baccalaureate standard of training in other fields of education, it became apparent that such a minimum program meant a variety of things to different individuals and groups in the field of pharmaceutical education. The publication of the National Pharmaceutical Syllabus, with its outline of a curriculum for the four-year course, has not clarified the situation to the extent that one might reasonably expect. There are still educators in the field of pharmacy who talk in terms of hours and credits, as though education could be reduced to a mathematical basis and be administered in standardized doses to groups of individuals whose one outstanding group-characteristic is lack of uniformity in mental equipment, in aptitude and in educational background. In this connection, one is reminded of the discussions in the early days of standardization of pharmaceutical products by means of physiological assays. Pharmacologists reported that there was wide variation in their results of the determination of the physiological activity of tincture digitalis upon frogs. Some one slyly remarked that since the pharmacologists were all experts and their technique appeared to be perfect, the difficulty must be with the frogs, and therefore the thing to do was to standardize the frogs. As a matter of fact, methods have since been devised of measuring variability in the reaction of frogs to digitalis, but whether we can succeed in so altering or selecting the human beings coming to us for education in pharmacy that education in standardized and measured units may be applied to all with equal success is at least doubtful.

The tendency in elementary and secondary education is in the direction of greater individual attention to the student and a development of the faculties for which he shows a particular aptitude. In our colleges of liberal arts and sciences the trend is in the same direction. It is presumed, of course, that when an individual selects a professional course he is doing so because he has definitely made up his mind that it is a field in which he desires to work, and, furthermore, that he has certain capabilities which will make it possible for him to qualify in this field. It is hardly fair, however, to place the entire responsibility upon the student. The college of pharmacy which accepts him has a certain responsibility which it should not shirk. One of the unfinished tasks of pharmaceutical education is the development of methods of selecting personnel from which future pharmacists are to spring. Unless the next generation of pharmacists develops a type of leadership which will carry the profession into fields of activity that are more nearly in line with developments in medicine and dentistry, we must look forward to a diminution of professional activity in the drug stores of the United States, and an increasing absorption of the professional function of the pharmacist by group practitioners and institutional organizations.

The recent attempt to include in a four-year course the cultural and basic education which it is acknowledged should precede the more technical training of the pharmacist may or may not be successful. Already we are hearing an increasing volume of critical comment against the present arrangement. It would not be at all surprising to find that within the next five years colleges of pharmacy everywhere will do what is now being done in some of our universities, namely, devote their entire time and attention to the technical training of pharmacists who will qualify for admission to the pharmacy course by completion of a pre-pharmacy course of one or two years, or perhaps graduation from a junior college. It is interesting to note in this connection that a study of the freshman enrolment in pharmacy colleges for the past ten years, throughout the United States, shows a gradual but steady decrease in the number who are choosing pharmacy for their life work. In 1924 sixty-six colleges of pharmacy in the United States enrolled 5,288 freshmen. In 1933 these colleges enrolled 2,469 freshmen. This represents a drop of 53 per cent. The drop has been gradual, but steady, up to 1930. In 1931 it was very slight. In 1932, however, it was extremely abrupt. This is, of course, due in part to the depression and in part to the four-year course. How much of the drop has been due to increasing standards is a matter of interest. As a basis for comparison, we have the statistics for the schools belonging to the American Association of Colleges of Pharmacy, all of which began the four-year course in 1932 or previously, and the schools of pharmacy in the State of New York which are not members of the association of colleges and which are not yet on the minimum four-year course basis. The figures are as follows: 66 colleges of pharmacy throughout the United States showed a drop in enrolment in the freshman classes of 39.2 per cent. between 1929, which was the peak

year of the boom period, and 1932, the year during the depression when the four-year course went into effect. Fifty-two of the 55 colleges of pharmacy holding membership in the American Association of Colleges of Pharmacy dropped 36.4 per cent. in the enrolment of their freshman classes during the same period. The six New York schools dropped 46 per cent. in their enrolment from 1929 to 1932. As they did not adopt the four-year minimum course in 1932, and as their drop in enrolment is greater than that of the schools which did increase the requirement in 1932, and also greater than the drop in all schools, it is safe to assume that whatever drop in enrolment there has been is due more largely, if not entirely, to the depression and to an increasing lack of interest in pharmacy as a career than to the increase in educational requirements.

The training for leadership in pharmacy can not be completed in the minimum pharmacy course. An effort must be made to select from among graduating classes a certain few who appear to possess the qualities which make for constructive leadership and the promotion of professional idealism. These selected representatives of our graduating classes must be given an opportunity to develop not only in scientific fields, but in the field of economics as applied to pharmacy, in the field of law enforcement as applied to pharmacy and in the field of teaching as applied to pharmacy. Unless greater opportunity is provided to train leaders in pharmaceutical thought, just as we have already provided for the training of leaders in the development of science as applied to pharmacy, our growth will be one-sided and we will continue to turn out a group of skilled pharmaceutical scientists on the one hand, a lot of mediocre practitioners on the other hand, with but few properly equipped leaders to guide the progress of the many in their attempt to apply the art and science of pharmacy to the problems that daily arise to plague the retail druggist.

LICENSURE AND LAW ENFORCEMENT

In the field of pharmaceutical licensure and law enforcement there are many major unfinished tasks. There is not sufficient uniformity in the regulations governing the practise of pharmacy and the dispensing of drugs and medicines in the various states of the Union. Fortunately, the American Pharmaceutical Association has had its attention called very forcibly to this situation, and it is hoped that with the completion and endowment of the headquarters in Washington it will soon be possible to undertake studies which will establish the facts about the existing order and lay the foundation for sorely needed reforms.

When the public once becomes conscious of the laxity with which the sale of drugs and medicines is controlled in the United States, it may be expected that drastic changes will be advocated and put into effect.

On the assumption that persons familiar with the practice of pharmacy and engaged in that practise are best equipped to regulate it and to determine who is and who is not fit to practise it, practically all the laws governing the practise of pharmacy in the United States provide that boards of pharmacy shall be composed of licensed pharmacists who have spent a certain number of years in active practise and who are engaged in the retail drug business. In theory, no fault can be found with such an arrangement. In practise, however, it frequently does not work out. Some state laws provide that the persons to be appointed to boards of pharmacy shall be recommended by state pharmaceutical associations. They further provide that in making recommendations for the appointment, a certain number of those recommended shall be of one political faith and an equal number of the opposite political faith. Just what this has to do with the competence of an individual to judge whether an applicant is fit to practise pharmacy or not is not apparent. Just what bearing the political faith of a board member may have upon law enforcement is, however, quite apparent. There are states in which the political phase does not enter into board appointments at all. This does not mean that political pressure is not brought from time to time upon board members to do things which will favor certain individuals. However, if board appointments in the first place are made without political consideration, the board member is in a position to resist such pressure and hew to the line, regardless of the consequences.

The difference in educational standards in the various states, the difference in the personal standards of appointees to the boards of pharmacy and the difference in legal standards for the enforcement of regulations governing professional practise are so great that it is a tribute to pharmacy in general that things have gone along as well as they have. How to bring backward states into line and what to do to impress members of a legislature with the importance of fair and honest regulation of the practise of pharmacy constitute a problem to which pharmaceutical organizations and high-minded pharmacists have devoted much time and attention. Considerable headway has been made, but much remains to be done.

The make-up of boards of pharmacy at the present time is such that the public is apt to accept at its face value the argument that pharmacy laws are being enforced for the benefit of pharmacists rather than for the benefit of the public. This is particularly true when it comes to the sale of drugs and medicines through outlets other than established retail drug stores. Unfortunately, the public loses sight of the fact that drugs and medicines and even packaged or

patented medicines are not mere merchandise. Many a proposed pharmacy law has been defeated in the legislature because of pressure brought by patent medicine interests and general storekeepers who feared a loss of trade and were able to convince members of the legislature that pharmacists were seeking monopolies. Perhaps the time has come in states where legislation for the regulation of the practise of pharmacy has been difficult to obtain to ask for the appointment of a commission of high-minded and public-spirited citizens to study the respective arguments and claims of those who favor and those who oppose legislation affecting the practise of pharmacy. Such a commission would soon be able to determine the relative merits of the claims made and would silence the opposition of those who are instrumental in withholding advancement of standards for pharmaceutical licensure, for no good reason.

Perhaps the time has also come when various states should add to their boards of pharmacy high-standing laymen of the type usually appointed by our governors to managing boards of institutions or to health departments. Such a lay board member would not be expected to act as an examiner of applicants for registration, but he should be expected to sit with the professional members of the board at hearings involving violations of the pharmacy act and in meetings where matters of public policy with respect to the sale of drugs and medicines are considered.

The addition of such lay members to boards of pharmacy, or to any other professional boards, for that matter, would add a view-point which would be very helpful, especially in these days when talk of socialization of the activities of members of the healing arts occupies such an important place in public and private discussion. They would also be in a position to act as interpreters of the view-point of the pharmacy board to the public.

A National Examination

Another very helpful step in the improvement of standards of licensure, as well as standards of pharmaceutical practise, would be the launching of an effort to provide a uniform nation-wide examination in the fundamental subjects now given by the respective boards of pharmacy.

I have proposed that the National Association of Boards of Pharmacy conduct such an examination annually and simultaneously for the graduating class of every college of pharmacy in the United States, and that the results of this examination be certified to every board of pharmacy in the United States so that graduates of the respective colleges of pharmacy may receive permanent credit toward a registered pharmacist's certificate for these examinations if they pass them. It would then be necessary for the applicant merely to submit, to the state board from which he desires to obtain a license, evidence of his personal qualifications and practical experience, and to be given a practical examination in the compounding and dispensing of drugs and medicines. Not only would such an annual national examination be an advantage to the prospective registrant because he would be able to qualify at a time when he is best prepared to do so, but it would also give confidence to all boards in the fitness of an applicant who may come into a state by reciprocal registration years later. Every board would know that political or personal influence had no bearing on the candidate's examination record. At the same time, each board would still maintain its prerogative of examining the applicant in the work in which it is most competent to test him, namely, the practical conduct of a pharmacy and the compounding and dispensing of medicines. Such a national examination would not be without influence upon the colleges of pharmacy, for it would act as a stimulus toward more careful study of the quality of teaching and testing within these institutions, inasmuch as their products will be measured by a common yardstick.

Professional Solidarity

The final unfinished task to which I desire to refer is that of developing a professional solidarity within our ranks which will do for pharmacy what is being accomplished in medicine, dentistry, chemistry and many other fields.

We suffer not from a lack of organization or organizations, but rather from over-organization. Yet with all the state and local associations of pharmacists scattered over this broad land, and with two national organizations ready and willing to function respectively in the professional and economic fields, it must be confessed that no existing organization can to-day truthfully claim to speak authoritatively for the profession as a whole. It seems clear that the approach to professional solidarity must contemplate a complete understanding of the relative functions of our two national associations; a definite liaison between local and state and state and national associations such as we have in medicine and in dentistry, and the development of a mutual confidence which will throw the full weight and power of the individual pharmacist into his local association, that of the local association into the state association, and that of the state associations into both national associations. It will then remain for the two national associations to arrive at a basis for mutual helpfulness and cooperation. Those occupying high places in these national associations must bear in mind that they are the custodians of the ideals of the profession, of the beliefs its members cherish and of the faith which makes a unit of a mere aggregation of individuals.

OBITUARY

WALTER JONES

WALTER JONES, professor emeritus of physiological chemistry at the Johns Hopkins University, died in Baltimore on February 28, 1935, at the age of seventy years. He is survived by his wife and daughter.

In 1927, when he retired because of ill health, Walter Jones had served the School of Medicine thirty-one years, first under the leadership of Professor John J. Abel and from 1908 as professor of physiological chemistry. He had received his A.B. from "The Hopkins" in 1888 and his Ph.D. in 1891. Thus he completed nearly a lifetime of association with a university founded in the city of his birth. There were short periods at Wittenberg College and Purdue University and of study abroad.

It was at Marburg, as an ardent student of the elder Kossel and an admirer of the pioneer Friedrich Miescher, that Jones found his field to be the chemistry of the nucleic acids. His monograph, "The Nucleic Acids," remained for a long time a standard treatise on this difficult subject in which center the clinically important topic, purine metabolism, and the cytologically important problems which are destined to depend upon the characterization of these cell constituents. One who has not lived with this subject will have difficulty in appraising the work of contributors and I shall leave to more competent hands a review of Jones's work. Yet I think it evident that his place can not be described merely by the naming of particular discoveries. He had a part in bringing a complicated subject out of obscurity. If, during the exposure and preliminary dissections, mistakes were made, they were of the sort which stimulated advances. In the final conclusions many of Jones's substantial contributions are embedded.

For his eminence as an investigator Dr. Jones was made a member of the National Academy of Sciences and twice president of the American Society of Biological Chemists.

An aspect of Walter Jones's character that deserves mention is found in his relation to students. Temperamentally impatient with mediocrity he attracted to his own field of research a select group of medical students as well as assistants. In his bibliography will be found as joint authors names remarkable for the preponderance of their association with later acquired distinctions. In short, Jones detected ability. Many a run-of-the-mine student had painful experiences, and yet Jones's colleagues attest to the care with which he prepared to meet the needs of raw recruits. This was particularly true of his lectures, and they were brilliant. It is not often that a lecturer can recapture the attention of those who have passed a required course. Yet upper classmen returned year after year to the old hall where Professor Jones presented the elements of physiological chemistry to first-year students. Doubtless they did so partly for the occasional entertainment; but, on the whole, it was clearly for the inspiration. Many, indeed, were the occasions when entertainment was afforded, as when a forgetful student was startled by the assertion that even a street-car conductor should know all the amino-acids or when a polemic with Schittenhelm was exposed in all its gory detail. It has been said that there were periods when a student might have gotten the impression that the whole of physiological chemistry was concerned with nucleic acids and related subjects. Doubtless weathering has made prominent the tougher strata of memories. Yet, even if the charge were true, it would be easy to find good reason. Intense concentration was Jones's habit. Furthermore, he hated bluff. He would offer admission of dim memory before admission was demanded. He would speak only fully catalyzed thoughts. He was never bound by classic definitions of his subject. Capable as he was of the exposition of diverse subjects he gave to his students only the best that was in him at the moment. In so doing he gave far more than the immediate subject-matter. The better students appreciated this at the time and in later years they bring back tales which make a fine tradition.

The high intensity at which Walter Jones's energy was displayed made him a person difficult to appreciate by those who were unprepared. A flame might burst forth at the lunch table or the bank teller's window. People grew nervously expectant. Unagile minds, like my own, seldom caught up with even the kindling of the flame, were left uneasy and inclined to avoid future consternation. Yet when the flame appeared after the rendering of a symphony or during the discussion of a book one knew that here was a man who had lived with the composer or achieved with the hero while holding the critic's appraisal of the work of art. To Walter Jones's unique synthesis of the emotional and the logical few could rise and those who could inevitably failed to sustain themselves. Perhaps it was when he detected evidence of lagging that he brought forth those prickings of belief and custom and convention that might awaken the dozing listener. Even so it may be doubted that any one could resolve the whimsical, the mischievous and the serious elements. It was, of course, inevitable that bits of the mischievous not always would harmonize with the amenities, but he who would make much of this should remember the unswerving loyalty of friends. This speaks volumes.

It was this high level of intensity, at which alone

his abilities would work, that explains Walter Jones's premature disappearance from the annals of biochemistry. After his official retirement and when better health permitted, he was ushered into a new laboratory planned for his use. For a moment the old eagerness returned; for a few hours laboratory equipment took form; then a sudden disappearance and no return. A more placid mind could have given us those slowly ripening fruits of age that are needed by a generation accustomed to the strenuous life. Walter Jones knew only and loved only the strenuous life, and when the body could no longer respond fully to the iron will he felt his career to be ended. Thenceforth a complete silence in all scientific matters must have concealed what we can only guess.

If a mind so independent can be said to have harbored ambitions for recognition, three such ambitions were fulfilled. Walter Jones attained an honorable and honored place in the history of his chosen science. He commanded the respect of his students as an inspiring lecturer. He won the loyalty of those who labored with him. These are not the least of possible attainments, and from an imperfect acquaintance enriched at his fireside in the hills of Maryland I am led to suspect another, more satisfying to the man himself. It must have been that had the gods permitted the removal of disguise he could have told us something of Olympus; for there were moments in his discussion of great matters in literature and music when he spoke as one who feels that "it is given to the gods to know one another when they meet."

WM. MANSFIELD CLARK
THE SCHOOL OF MEDICINE
THE JOHNS HOPKINS UNIVERSITY

ALBERT MANN
1853–1935

THE Diatomaceae have but few students in North America, in fact throughout the world, due, somewhat, to the difficulties attending their study. The passing of one of these students, recognized not only as the dean, but also as the foremost authority here, is of inestimable loss to those enthusiasts who have been attracted by the beauty and symmetry of these lowly plants.

Dr. Albert Mann died at his home in Middletown, Conn., on February 1, 1935. He was born at Hoboken, N. J., on June 30, 1853, the son of Albert and Lydia Helen (Everett) Mann. Educated at Wesleyan University, Middletown, he graduated in 1879, where later the degrees of M.A. and Sc.D. were conferred; and then continued studies for the ministry at Drew Theological Seminary until 1880. On October 6, of that year, he was married to Jennie F. Yard, of Trenton, N. J., who survives him with a son Albert, born in 1883, and now professor at Wesleyan University. From 1880 to 1892, Dr. Mann was pastor of various churches, in Philadelphia, Verona, N. J., Bloomfield, N. J., and Newark, N. J.

It was in the early years of his pastorate, in Philadelphia, that he met the late Charles H. Kain, a well-known diatomist of his day, and then began that interest in the diatoms which continued throughout his life. While resident in New Jersey, he was active in microscopical circles as member and vice-president of the old Essex County Microscopical Society, specializing in the diatoms, and in the last year of his pastorate in St. Luke's M. E. Church, Newark, he prepared his first paper on the group, entitled, "List of Diatomaceae from a Deep-sea Dredging in the Atlantic Ocean off Delaware Bay by the U. S. Fish Commission Steamer Albatross." The paper was published in the Proceedings of the United States National Museum, Vol. XVI, pages 303–312, 1893.

Severing his official connections with St. Luke's M. E. Church to enter on a scientific career, he left for Germany in 1892 to study at the University of Munich, where, on graduation in 1894, he received the degree of Ph.D. On his return to the United States he was tendered the chair of professor of botany at Ohio Wesleyan University, which he filled until 1900. The following years, up to 1905, were spent as collaborator of the University of Munich, and in scientific investigations at the Smithsonian Institution in Washington. The spare hours were used for the research work necessary to the preparation of the exhaustive "Report on the Diatoms of the Albatross Voyages in the Pacific Ocean, 1888–1904," which appeared in 1907. In 1905 he commenced the long services, lasting 14 years, as a scientific specialist in the U. S. Department of Agriculture, in Washington, and in the early part of that period was also professor of botany at the George Washington University.

It was not until 1919 that Dr. Mann realized the fulfilment of his dream—the establishment in Washington of a laboratory, solely for diatom research, with himself in charge as an associate of the Carnegie Institution. Suitably installed in the Smithsonian Building, it soon became headquarters—as he called it—for students and others interested in the economic uses of the diatoms. With more time at his disposal, the large, important, taxonomic paper on the "Marine Diatoms of the Philippine Islands" was published in 1925. Many smaller papers were written then and during earlier periods of his life, on diatoms and other subjects related to his professional work, but space will not permit the listing here. Research work commenced and unfinished at the time of his death will be continued, it is hoped, by one of his associates at the laboratory.

Dr. Mann was a member of the American Association for the Advancement of Science since 1894, and a fellow since 1911; a member of the Cosmos Club of Washington for many years; and a member or fellow of many other scientific organizations.

Endowed with high mental qualities, and, having a profound knowledge of the fields into which an active and varied career led him, his contributions to a study commenced in early manhood as a hobby are of the highest importance. Sterling character, charming personality and kindliness of spirit endeared him to his friends. His passing is sorrowfully noted by one who regards the period of the friendship of many years as one of the happiest of his own life.

ROBERT HAGELSTEIN

NEW YORK BOTANICAL GARDEN

MEMORIALS

THE aeronautical laboratory of the Rensselaer Polytechnic Institute, built at a cost of $500,000, has been named the Ricketts Building, in memory of Dr. Palmer C. Ricketts, president and director of the institute for more than fifty years. Dr. Ricketts died last December.

THE Board of Managers of the New York Botanical Garden at its annual meeting designated the general herbarium of the garden as the Britton Herbarium, in honor of Dr. N. L. Britton, lately director of the institution. The reference collections, in all units, now contain 1,774,687 specimens, a collection particularly rich in types and in historical material.

CORNELL UNIVERSITY has unveiled a bronze memorial plaque commemorating the achievements and service of the late Stephen Moulton Babcock, the inventor of the Babcock test. The cast is a replica of the one executed by the sculptor, Lorado Taft, and presented to the University of Wisconsin by friends of Dr. Babcock in October, 1934.

A PORTRAIT of Lavoisier, "father of modern chemistry," and his wife has been presented to Yale University by the students and associates of Dr. Lafayette B. Mendel, Sterling professor of physiological chemistry. The painting will eventually hang in the seminar room of Dr. Mendel's department. Permission was granted by the trustees of the Rockefeller Institute for Medical Research to copy this painting by Jacques Louis David, which was acquired by John D. Rockefeller, Jr., in 1925 and now hangs in the library of the institute.

THE German Röntgen Society has recently had a memorial tablet erected to Röntgen at Pontresina in the Engadine, where for more than forty years he spent his annual holiday.

A RESOLUTION providing for the transfer of the bodies of Pierre Curie and Mme. Marie Curie to a tomb in the Paris Pantheon has been approved by the education committee of the French Senate. The tomb will be beside that of the chemist, Marcellin Berthelot.

RECENT DEATHS

THE body of Dr. George H. Bigelow, director of the Massachusetts General Hospital and the Massachusetts Eye and Ear Infirmary, Massachusetts State Commissioner of Public Health from 1925 to 1933, who disappeared on December 3, was found on March 23 in a reservoir near Framingham, Mass., where he was born. Dr. Bigelow was forty-four years old.

DR. GEORGE EDWIN JOHNSON, professor of zoology and mammalogist of the Agricultural Experiment Station, Kansas State College, died on March 18, at the age of forty-five years. A correspondent writes: "Dr. Johnson had made a considerable contribution to the knowledge of the physiology of hibernation. He had been for eight years the efficient secretary of the Kansas Academy of Science."

SCIENTIFIC EVENTS

MEASUREMENTS OF GRAVITY OVER THE NIPPON TRENCH

IN the *Proceedings* of the Imperial Academy of Tokyo, Japan, for December, 1934, is an article entitled "Measurements of Gravity over the Nippon Trench on Board the I. J. Submarine Ro-57," by Motonori Matuyama, which should interest all those who are dealing with the configuration of the ocean bottoms.

According to Dr. Matuyama's article, a pendulum apparatus of the Meinesz type was purchased in Holland and was delivered in Japan in July, 1932. The instrument was given a careful examination in the laboratory of Dr. Matuyama and a few changes were made in some of the smaller or minor parts of the apparatus. In October, 1932, the apparatus was put aboard the submarine Ro-58 to do some practice work in measuring gravity in Sagami Bay. The submarine dived five times in two days.

The first real gravity survey by Dr. Matuyama was made over the Nippon Trench in October, 1934, aboard the submarine Ro-57 commanded by Commander A. Hudii. He was accompanied by N. Kumagai and two assistants. Junior Captain T. Akiyosi, a member

of the Hydrographic Office, was ordered by the Imperial Navy to sail on the submarine and to help in the management of the expedition. Dr. Matuyama spoke highly of the assistance rendered by Captain Akiyosi, especially in determining the positions and velocities of the submarine.

During the trip 27 measurements of gravity were made during twenty-five submergences of the submarine. In two cases, 2 measurements were made as checks during a single submergence.

At the time of writing his paper for the *Proceedings,* the photographic records and other data connected with the gravity surveys were being carefully studied and it is expected that the final results will be published later. Approximate values of gravity have been calculated and the results are shown on a map accompanying Dr. Matuyama's article together with the free air gravity anomalies. It is hoped that these gravity stations may be reduced by the isostatic method in order to throw some light on the isostatic condition of the crust under the Nippon Deep and surrounding areas.

W. B.

STREAM SURVEYS OF THE NATIONAL FORESTS AND PARKS

During 1934 the Bureau of Fisheries sent sixteen field parties to the different national forests and national parks for the purpose of studying and reporting on the physical, chemical and biological conditions of the streams and lakes lying within the forest or park areas. With this accumulated information as a basis, the aim was to improve the fishing in these areas by adopting a policy of planting the species, size and number of fish for which each surveyed stream or lake is best adapted.

However, the forests and parks were not the only ones to benefit from such a survey. The Bureau of Fisheries has accumulated a great deal of information which may be valuable in the future. The information can hardly be called new, but it is a more concise and quantitative statement of what is rather generally known.

In the East the four parties surveyed, completely or in part, the Great Smoky Mountain National Park in Tennessee and North Carolina and the following national forests: Green Mountain and White Mountain in New England, George Washington and Monongahela in Virginia and West Virginia and Pisgah and Nantahala in the two Carolinas and Georgia.

In the West the twelve parties surveyed, completely or in part, Glacier National Park and the following national forests: Sierra, Shasta, Klamath, Monoluyo, Coconino, Santa Fe, Humbolt, Roosevelt, Wasatch, Tonto, Crook, Coronado, Teton and Wyoming.

Comprehensive reports were compiled from the individual report blanks. These enlarged reports give a description of the methods of survey; a brief account of the physiography of the region; a list of the fishes found in the region; a statement of the natural enemies of fish present; a discussion of the kinds and relative abundance of aquatic fish food; notes on the water fluctuations of the streams and lakes and comments on the accessibility of the waters and the fishing intensity. Included with each of the reports are tables giving the following information about the streams: length, average width, average depth, average volume, gradient, character of stream bed, vegetation, pool grade, food grade, abundance of shade, game fish present, degree fished, fish recommended for stocking, size, section to be stocked, length of section, number of fish per mile, frequency and remarks. For lakes a table is included which gives the following: area, elevation, maximum and average depth, bottom food, plankton, vegetation, character of bottom, whether lake is natural or artificial, extent of shoals, degree fished, fish recommended, size, number, frequency and remarks. These tables are designed to furnish the Forest and Park Services with the major characteristics of each lake and stream and to give stocking suggestions for these waters.

THE JOHNS HOPKINS UNIVERSITY RESEARCH CONFERENCES ON CHEMICAL PROBLEMS

THE chemistry department of the Johns Hopkins University is holding its fifth Research Conference this summer at Gibson Island near Baltimore. The conference will be under the general direction of E. Emmet Reid and will run three weeks from June 24 to July 12. The plan is flexible, varying from day to day according to the nature of the topic under discussion and the wishes of those participating. The day begins with a more or less formal lecture outlining some field of research and directing attention to its unsolved problems. This is followed by a discussion in which each one present takes part, making what contribution he can to the solution of the problems presented. The ideal is to have a group large enough that all points of view may be represented, yet small enough that all who wish may take active part. The plan is to have recognized leaders in each field of research give the lectures and start the discussions, but its success depends on having a number in the group who are capable of contributing ideas. The remainder of the day is left to sports or conversations. These conferences are intended to combine mental stimulation, pleasant personal contacts and healthful recreation. The Gibson Island Club generously shares its facilities for this period. The club has an excellent golf course, fine tennis courts, splendid swimming and beaches, with ample dressing rooms

and commodious club house. There is excellent fishing in the surrounding Chesapeake. Attendants on the conferences may secure rooms in the club house or in adjacent cottages or may come from Baltimore for the day. Meals for all are served at the club house.

The program given below is to be regarded as a tentative outline to be filled in or modified as may seem best.

1. *The Chemistry of the Aliphatic Free Radicals:* Professor Francis O. Rice, June 24–28.

The week's conferences will include a series of lectures and discussion on (1) the preparation and properties of free aliphatic radicals, (2) the mechanism of thermal decompositions from the free radical standpoint, and, (3) the Haber-Willstätter chain mechanism applied to reactions in solution.

2. *Long Chain Molecules:* Dr. Thomas Midgley, Jr., July 1–5.

July 1. Formation of polymers by definite chemical reactions; rings and string molecules, Dr. W. H. Carothers.
July 2. Synthetic rubber, Duprene and Thiokol, Dr. W. H. Carothers and Dr. J. C. Patrick.
July 3. The determination of molecular weights of big molecules, Dr. E. O. Kraemer.
July 4. Cellulose, Dr. E. O. Kraemer.
July 5. Rubber, Dr. T. Midgley, Jr.

3. *Vitamins:* Dr. E. V. McCollum, July 8–12.

These conferences consist of lectures and discussion grouped around work in progress on vitamins.

July 8. Vitamin A, Dr. E. V. McCollum.
July 9. Vitamin B, Dr. R. R. Williams.
July 10. Vitamin C, Dr. C. G. King.
July 11. Vitamin D, Dr. C. E. Bills.
July 12. Vitamin G, Dr. H. C. Sherman.

NEIL E. GORDON
THE JOHNS HOPKINS UNIVERSITY

COLD SPRING HARBOR SYMPOSIA ON QUANTITATIVE BIOLOGY

IF we may judge from the results of two years, the conference-symposia method as developed at the Biological Laboratory at Cold Spring Harbor is a successful experiment in method. The cooperation of outstanding chemists, physicists and mathematicians, as well as biologists, has been most gratifying. The unique bringing together of knowledge from these various sources upon a fundamental aspect of biology each year is already widely appreciated. Thus the annual volume resulting from the symposia and discussion is purchased in over twenty-five countries all over the world, and there is evidence that the distribution of the volumes is becoming extended.

This year the conference-symposia will be centered about photochemistry in biology and medicine. They will take place during five weeks, June 26 to August 1. The general aspects which will be considered are: basic photochemistry (June 26–July 2), photosynthesis (July 3–July 16), photoreceptors and bioluminescence (July 17–July 23), and photochemistry in medicine (July 24–July 30).

While plans are still incomplete, it is already known that the following men will present papers, and, with five exceptions, will be in residence from one to five weeks at least:

Dr. Vernon M. Albers, physicist, Kettering Foundation, Antioch College; Dr. William Arnold, Biological Laboratories, Harvard University; Dr. Charles E. Bills, biochemist, director, Research Laboratories, Mead Johnson and Company; Dr. Harold F. Blum, assistant professor of physiology, University of California Medical School; Dr. F. S. Brackett, physicist, Bureau of Cotton Economics, Department of Agriculture; Dr. Dean Burk, associate physical chemist, Bureau of Chemistry and Soils, Department of Agriculture; Dr. E. S. Castle, assistant professor of physiology, Harvard University; Dr. M. Demerec, investigator, Department of Genetics, Carnegie Institution of Washington; Dr. N. R. Dhar, head of Chemistry Department, University of Allahabad (India); Dr. Robert Emerson, Biological Laboratory, California Institute of Technology; Dr. Henry Eyring, physical chemist, research associate, Princeton University; Dr. Hugo Fricke, in charge of biophysics laboratory, Biological Laboratory; Dr. H. Keffer Hartline, fellow medical physics, Johnson Foundation, University of Pennsylvania School of Medicine; Dr. E. Newton Harvey, professor of physiology, Princeton University; Dr. Selig Hecht, professor of biophysics, Columbia University; Dr. O. L. Inman, director, Kettering Foundation, Antioch College; Dr. H. V. Knorr, physicist, Kettering Foundation, Antioch College; Dr. Henry Laurens, professor of physiology, Tulane University School of Medicine; Dr. H. S. Mayerson, assistant professor of physiology, Tulane University School of Medicine; Dr. Harold Mestre, Department of Bacteriology, Yale University School of Medicine; Dr. Karl Meyer, Department of Ophthalmology, College of Physicians and Surgeons; Dr. W. A. Noyes, Jr., associate professor of chemistry, Brown University; Dr. Gerhard K. Rollefson, associate professor of chemistry, University of California; Dr. Paul Rothemund, biochemist, Kettering Foundation for Study of Chlorophyll and Photosynthesis, Antioch College; Dr. S. E. Sheppard, chemist, assistant director Kodak Research Laboratories; Dr. Hugh S. Taylor, David B. Jones professor of chemistry, Princeton University; Dr. George Wald, Biological Laboratories, Harvard University; Dr. Ernst Wolf, Biological Laboratories, Harvard University; Dr. F. Paul Zscheile, Jr., Department of Chemistry, University of Chicago.

Investigators who wish to attend various symposia and discussion may obtain more definite information, including programs, from the Biological Laboratory at Cold Spring Harbor.—R. G. H.

SCIENTIFIC NOTES AND NEWS

THE House of Representatives has passed a bill conferring the Congressional Medal of Honor on Major General A. W. Greely, the Arctic explorer. General Greely celebrated his ninety-first birthday on March 27.

THE New York-New Jersey Alumni Association of the Johns Hopkins University will hold a dinner at the Hotel Plaza, New York City, on the evening of April 5 in honor of Dr. Joseph S. Ames, who retires as president of the university in June, and of Dr. Isaiah Bowman, president-elect, now chairman of the National Research Council and director of the American Geographical Society of New York.

DR. E. D. MERRILL, director of the New York Botanical Garden, and Dr. A. B. Stout, director of the laboratories of the garden, have been elected honorary fellows of the British Royal Horticultural Society and also honorary life members of the Pennsylvania Horticultural Society.

THE Hillebrand Prize, awarded annually by the Washington Chemical Society for the best paper read before it during the preceding year, was presented at the Cosmos Club on March 14 to Frederick Rossini, of the Bureau of Standards, for his paper on "The Thermal Decomposition of Alcohols."

THE gold Moulton Medal of the British Institution of Chemical Engineers for 1934 has been awarded to J. Davidson Pratt and G. S. W. Marlow, for a paper entitled "Legal Pitfalls for the Chemical Engineer." The Junior Moulton Medal in silver, for the best paper of the year read before the graduates and students' section of the institution, was awarded to D. Gordon Bagg for his paper entitled "Determination of the Efficiency of a Multi-Stage Washer."

THE Paris Academy of Sciences has awarded the Jean Dagnan-Bouveret prize of 15,000 francs to Drs. Auguste Charles Marie and Paul Remlinger for their work on rabies, and the Lacage prize of 10,000 francs to Professor Portier for his physiological studies.

Nature states that the University of Toronto has awarded the Charles Mickle fellowship for 1935 jointly to Dr. Edward Mellanby and Mrs. May Mellanby. The fellowship is endowed under a bequest by the late Dr. W. J. Mickle, and is awarded annually "to that member of the medical profession who is considered by the council of the Faculty of Medicine of the University of Toronto to have done most during the preceding ten years to advance sound knowledge of a practical kind in medical art or science."

W. A. S. CALDER, delegate director of the general chemicals group of Imperial Chemical Industries, Limited, has been elected president of the British Society of Chemical Industry for the year 1935–36.

OFFICERS of the British Institute of Chemistry were elected at the annual meeting on March 1 as follows: *President,* Professor Jocelyn Field Thorpe; *Vice-presidents,* W. J. A. Butterfield, Sir George Clayton, Dr. A. E. Dunstan, F. G. Edmed, Dr. H. H. Hodgson and W. H. Roberts; *Honorary Treasurer,* P. H. Kirkaldy.

DR. BENJAMIN LINCOLN ROBINSON has resigned from the Asa Gray professorship of systematic botany and the curatorship of the Gray Herbarium of Harvard University. His resignation, though accepted by the president and fellows of Harvard College at the meeting on March 18, is to date from September 1, from which time he has been appointed Asa Gray professor of systematic botany and curator of the Gray Herbarium, emeritus. As he completes his service at the close of the present academic year, Dr. Robinson will have held the curatorship of the Gray Herbarium for forty-three years and will have occupied the endowed chair connected with it for thirty-five years. Dr. Robinson will continue his monographic studies of the *Compositae-Eupatorieae* on which he has long been engaged.

F. TRUBEE DAVISON, president of the American Museum of Natural History of New York City, whose term as alumni fellow of the corporation of Yale University expires in June, has been nominated unanimously for reelection.

DR. WILLIAM T. BOVIE, formerly assistant professor of biophysics at the Harvard Medical School and a member of the Harvard Cancer Commission, is continuing his work on the biological effects of rays in the Shannon Physical Laboratory at Colby College.

DR. REGINALD M. ATWATER, for eight years health commissioner of Cattaraugus County, N. Y., has been appointed executive secretary of the American Public Health Association. The appointment became effective on March 15.

DR. LEONARD GREENBURG, acting health officer of New Haven, has been placed in full charge of the department of health. He succeeds Dr. John L. Rice, who left New Haven to become health officer of New York City.

PROFESSOR LEO M. CHRISTENSEN, of the department of chemistry at Iowa State College, has resigned in order to join the staff of the Chemical Foundation. His work will be connected with the production of alcohol from farm products and the formulation of legislation fostering its use.

WILLIAM BRIDGES, lately of the New York *Sun*, has been appointed editor and curator of publications at the New York Zoological Society. He fills the vacancy left by the retirement on December 31 of Elwin R. Sanborn.

DR. ALFRED E. EMERSON, professor of zoology at the University of Chicago, left on March 22 for the Panama Canal Zone, where he plans to analyze the effect of changes of temperature, humidity and light upon the social life of termites. His headquarters will be on the island of Barro Colorado in Gatun Lake, Canal Zone, where the National Research Council maintains a biological station.

DR. L. J. KLOTZ, plant pathologist at the Citrus Experiment Station of the University of California at Riverside, has been granted five months' leave to study disease-resistant plants. He left Riverside on March 25 for Michigan State College, where he plans to carry on this research.

DR. CLARENCE A. NEYMANN, associate professor of psychiatry at Northwestern University, sailed on March 16 to give a special course of lectures at Liége, Louvain, Brussels and Ghent. He will speak also before the Royal Medical Society of London.

DR. A. RAYMOND DOCHEZ, professor of medicine of the College of Physicians and Surgeons of Columbia University, is visiting at the School of Tropical Medicine, San Juan, Puerto Rico, where he gave a lecture before the faculty and staff of the school and before the physicians of the island on "Influenza and Acute Infections of the Respiratory Tract."

THE Alpha-Beta Chapter of Sigma Pi Sigma, honorary physics society, at Syracuse University, recently sponsored two open meetings which were addressed by Dr. Harlow Shapley, director of the Harvard College Observatory, and Dr. W. F. G. Swann, director of the Bartol Research Foundation.

DR. RAYMOND PEARL, professor of biology in the School of Hygiene and Public Health of the Johns Hopkins University, delivered an address before the Washington Academy of Sciences on March 21. He spoke on "Biology and Human Trends."

THREE lectures on "Recent Progress in Astronomy" were given during March by Dr. Samuel Alfred Mitchell, director of the Leander McCormick Observatory of the University of Virginia, at the Wagner Free Institute of Science, Philadelphia. The titles of the separate lectures were "The Sun and Its Spectrum," "A Trip to the South Seas to Observe a Total Eclipse" and "The Distances of the Stars."

PROFESSOR H. RIES, of Cornell University, delivered the Orton Fellowship Lecture at the recent convention of the American Ceramic Society. He spoke on "Geology in Clay Research."

DR. CARL J. P. SKOTTSBERG, of Göteborg, Sweden, visiting professor at the Osborn Botanical Laboratory of Yale University, gave an illustrated lecture before the department of botany of Wellesley College on March 15 on "A Survey of Robinson Crusoe's Island."

THE Stuart McGuire lectures at the Medical College of Virginia will be given by Dr. Gunnar Nyström, professor of surgery, Uppsala University, Sweden, on the evenings of April 29 and 30. The subjects of the lectures will be "Embolism of the Arteries of the Extremities" and "Pulmonary Embolism."

DR. JOSEPH NEEDHAM, of the University of Cambridge, delivered two lectures on the Mead-Swing Foundation at Oberlin College on March 27 and 28, on "The Continuity of Chemical and Morphological Order."

THE psychologists of New York State, outside of the Metropolitan area, will hold their annual spring meetings at Colgate University, Hamilton, N. Y., on April 12 and 13. Dr. Fred S. Keller is in charge of local arrangements. Dr. B. F. Skinner, of Harvard University, will be the speaker at the dinner meeting.

THE dates for the May and June soirées of the Royal Society have been altered to Friday, May 3, and Friday, June 14.

THE tenth congress of the International Society of Surgery will be held in Cairo from December 30, 1935, to January 4, 1936, under the presidency of Professor A. von Eiselsberg, of Vienna.

THE seventh International Congress on Industrial Accidents and Diseases will be held at Brussels, Belgium, from July 22 to 27. The American Committee of the congress is under the chairmanship of Dr. Fred H. Albee, New York, for the Section on Accidents and that of Dr. Emery R. Hayhurst, Columbus, Ohio, for Industrial Diseases.

THE British Medical Association will hold its one hundred and third annual meeting in Melbourne, Australia, during the week beginning on September 9, under the presidency of Sir Richard Stawell, consulting physician to the Melbourne Hospital. The *Journal* of the British Medical Association reports that the sectional sessions for scientific and clinical work will be held on Wednesday, Thursday and Friday, September 11, 12 and 13. The annual representative meeting for the transaction of medico-political business will take place in London at the association's house on Friday, July 19, and following days. Members traveling to Australia through the United

States will sail for New York from Southampton on Saturday, July 27; if traveling by the Canadian route to San Francisco, they will sail for Montreal from Liverpool on July 26, or from Glasgow on July 27. The honorary local general secretary for this year's annual meeting is Dr. J. P. Major, Medical Society Hall, East Melbourne, Victoria.

THE trustees of the Surdna Foundation announce that Wesleyan University and ten welfare and religious institutions in Yonkers share in the first large distribution from the income from the fortune of the late John E. Andrus. The bequests amounted to $1,092,500, only a portion of the income of the foundation, which is said to be one of the most largely endowed charitable organizations in the world. Wesleyan University receives $300,000. Mr. Andrus, who died on December 26, at the age of ninety-three years, named the foundation by adopting the reversed spelling of his name.

THE National Zoological Park will receive an allotment of $680,000 from PWA funds. It is planned to build an addition to the bird house, a new elephant house and a house for small mammals, with special accommodations for apes. It is also planned to provide a machine shop.

THE private medical library of the late Dr. Bailey K. Ashford has been presented by his family to the School of Tropical Medicine at San Juan, Puerto Rico. This library contains a large collection of books, periodicals and pamphlets, together with valuable historical data on sprue, anemia and hookworm, in which fields Dr. Ashford had made notable contributions.

THE University of Cambridge has accepted an offer from the Department of Scientific and Industrial Research of the sum of £2,300 for building and equipping the extension to the Low Temperature Research Station on its southern side. It is to be used for scientific research and in the first instance for research in problems arising out of the preservation and handling of foodstuffs.

DISCUSSION

WHAT DO WE MEAN BY A BACTERIAL LIFE CYCLE?

BACTERIOLOGISTS have for some years been engaged in a vigorous, and sometimes slightly acrimonious, discussion of the question whether bacteria do or do not exhibit phenomena associated with a "life cycle." In a case of this kind, one always suspects that facts have been obscured by words. Arguments are generally concerned with words and ideas. Facts need not be argued about; they can be settled by observation.

In the present case, the facts are reasonably clear. Almost all bacteriologists will now acknowledge that many types of bacteria may at times exhibit morphological variants which differ rather widely from the forms most commonly observed in cultures. These variants may be swollen or branched or spherical, when the normal form is a regular rod. They may be larger than normal. Very frequently they are much smaller than normal. Furthermore, it is a well-established fact that some of these bizarre cells are not "involution forms"—if we mean by that term cells which are degenerating and necessarily doomed to perish. Many such abnormal cells, particularly the tiny coccoid forms of rod-shaped bacteria, have been shown to be viable and to reproduce the original type of organism. If by a life cycle we mean the occurrence of cells having a form different from that commonly observed in the species but capable of reproduction, then many bacteria have a life cycle. There is no essential difference between such a phenomenon and the familiar formation of endospores (except that the endospore has a special degree of resistance to unfavorable environmental conditions which many of the more recently described morphological variants lack).

Those who contend that bacteria lack a life cycle define the term more strictly. They consider that a "life cycle" must involve a certain inevitable and repetitive sequence of stages. In this sense they maintain that the bacteria do not possess a life cycle. If one transfers a culture in the phase of logarithmic growth to a fresh medium of the same kind, experience shows us that the form and size of the cells remain strikingly constant; and we have no reason to doubt that such a process can be continued indefinitely. A "cycle," according to Murray, means "a recurrent period (of events, phenomena, etc.)." Those who object to the life cycle theory may rightly maintain that such experiments exclude the existence of recurrent periods of varying morphology, due to some inherent tendency of the bacterial cells.

It is precisely, however, in this tacit assumption that a life cycle must be free from any environmental influence that there lies another dangerous pitfall of definition. If we allow that repetitive changes may directly result from environmental conditions and yet may constitute a life cycle, the balance of argument swings in favor of the "cyclists." If, instead of transferring a colon bacillus from one culture tube to another in the logarithmic phase of growth, we leave it

in the original medium for a longer period and then transfer it, a very definite series of repetitive events may be observed. The cells when first transferred to a new medium are small in size and exhibit certain quantitative physiological characteristics. Then for a certain period the cells become larger and physiologically far more active. The size may increase tenfold and the activity per cell fifty-fold. Later, both size and activity decrease again to their original figures. Under certain conditions, bizarre and coccoid and perhaps very minute or "filterable" forms may occur. On transfer to a fresh medium, the "cycle" repeats itself with perfect precision.

It must be freely granted that such a cycle is related to the effect of environment and not to any inevitable inherent tendency of a single cell; but I suspect that the same thing is true of all life cycles throughout the living world. The zoologist can cultivate protozoa, the botanist can cultivate molds, for an indefinite period by sufficiently rapid transfer to fresh substrates, without the appearance of cysts or spores or any other departure from the more usual morphological picture presented by the species. All that appears in such a case, if the medium be favorable, is the ordinary "life cycle" of binary fission. The phenomenon of endomixis does not present any real exception, since it does not alter the form or physiological properties of cells in any cyclical way. In the multicellular organism life cycles are apparently inherent simply because the organisms *are* multicellular and because the multicellular life produces a change in the environment of the individual cell more or less comparable to that produced in an old culture of bacteria. The germ cells exhibit no life cycles from generation to generation. It is true that in a metazoon there is a specialization of cell function associated with division and differentiation, but this is clearly degenerative rather than cyclical, since it is normally irreversible. Even specialized somatic cells when cultivated by Carrel *in vitro* show no life cycles after many years of observation.

May we not assume, then, that with all living cells, the "life cycle" so far as the individual cell is concerned—is a cycle of simple binary fission. Other phenomena involving change in cell morphology and physiology of a cyclical nature are responses to changing environmental conditions and not the result of any inherent time mechanism. If a unicellular organism shows a definite series of morphological and physiological alterations in response to certain changes in environment which are likely to occur with reasonable frequency in its natural life we may call it a "life cycle" if we wish or we may call it something else. In any case, this is the only kind of life cycle (other than binary fission) which can occur in unicellular and relatively simple multicellular forms. In this sense, the bacteria have life cycles. When we find a more complex and more regular life cycle in the higher plants and animals (relatively independent of external environment), it is because the interrelationships of the complex organism produce a cyclical change in the internal environment which is comparable with the change which takes place in a bacterial culture and which affects the individual body cell very much as the cultural environment affects the unicellular organism.

C.-E. A. WINSLOW

YALE SCHOOL OF MEDICINE

THE PRESS SERVICE AT THE PITTSBURGH MEETING

THE baffling problem of handling the paper winning the $1,000 prize appears at last to have been successfully solved. At Pittsburgh the announcement of the prize-winning paper was made at a conference of press representatives called for 9 A. M. at which a carefully prepared, clear and thoroughly intelligible résumé of the paper, and a biographical sketch of the author, were handed each one present, and arrangements were made for answering any questions that might be asked. The complete paper was also available. The release was for morning papers on the following day. Ample time was thus afforded the press representatives for studying the paper and for securing interviews on the subject-matter.

The proportion of the total number of papers sent in advance to the Press Service was slightly less than at the preceding Boston meeting. There were 1,806 papers (including demonstrations, etc.) listed in the program, of which 396 (20.2 per cent.) were received in advance.

If the 66 papers that were not received until after the meeting (partly because of having been mailed with insufficient postage) are added to the number sent in, and the 109 mathematical papers, which can not be handled successfully in the usual routine, are subtracted, there were 1,697 papers presented, of which 462 (23.5 per cent.) were received.

The number of papers listed and received, arranged by groups, was as shown in Table I.

This year each paper as soon as it was received was carded by author. By the use of this card catalogue the press representatives were able to find out at once whether or not a copy of any given paper was available, and all the essential information regarding the papers at hand. This card index proved to be exceedingly useful, and constant reference was made to it throughout the meeting.

For press purposes it is essential that information regarding the proceedings day by day shall be avail-

TABLE I

Section or Group	Papers	
	Listed	Received
Exhibits and Demonstrations	87	1
General Sessions and Committees	25	10
Joint Sessions	.....	14
Mathematics (A)	109	0
Physics (B)	149	37
Chemistry (C)	20	3
Astronomy (D)	21	7
Geology and Geography (E)	32	24
Zoological Sciences (F)	466	63
Botanical Sciences (G)	292	154
Zoology and Botany (F and G)	118	18
Anthropology (H)	55	21
Psychology (I)	42	23
Social and Economic Sciences (K)	40	12
Historical and Philological Sciences (L)	6	1
Engineering (M)	3	1
Medical Sciences (N)	48	26
Agriculture (O)	246	29
Education (Q)	33	16
Science in general (X)	14	2
Totals	1,806	462[1]

[1] Compare with table in SCIENCE, 79: 141, 1934.

able at a glance. Beginning at the St. Louis meeting the pages from two programs will be cut and pasted together in such a way as to show the proceedings of the entire meeting chronologically, with the available papers checked, and these strips will be placed on a bulletin board.

During the meeting two typists were present in the press room for the purpose of making copies, in duplicate, of those papers for which there was a special demand. This plan has been adopted at previous meetings and has worked very well. The ideal procedure, of course, would be to have all the material mimeographed, or at least to have at hand mimeographed copies of from 50 to 100 of the papers most likely to be of interest to the press. But the expense involved is prohibitive.

At the Pittsburgh meeting there were in attendance no less than sixteen press representatives from other cities, ten of whom were members of the National Association of Science Writers, and ten from the Pittsburgh papers and local offices of press associations.

Such marked attention on the part of the press places upon the association a grave responsibility. The meetings of the association form the chief medium through which the general public learns of the advance of science as a whole. We must make every endeavor for our own good to increase largely the proportion of papers made available to the press, and to see to it that all vice-presidential addresses and general sessions papers are submitted as long in advance as possible.

We must all work together in order that the press may have an abundance of suitable material to present to the public. Let us do all we can to assist the press in its effort to give the people an adequate and accurate picture of the progress of science as it is brought out at our meetings.

AUSTIN H. CLARK,
Director

THE COST OF GERMAN SCIENTIFIC JOURNALS

PUBLISHED protests on the unreasonably high prices of subscriptions to German technical periodicals are not effective. The present high price is not so much a matter of exchange conditions, although this is a factor, as it is the abnormally high initial price demanded by the publishers, amounting to extortion. Although after five years of depression, we are maintaining our library budget essentially unimpaired, I have directed that our subscriptions to sixteen German botanical periodicals be cancelled immediately. This has been done for the reason that subscriptions amounting to five to eight times as much as the rates charged for similar serials published elsewhere are not justified under any conditions. It is admitted that in a reference library broken sets of periodicals are regrettable, but when the cost per volume is so exorbitant, as in this case with those now discontinued, this is unavoidable. If other American institutions would do likewise, such action might be effective in reducing the present plethora of abnormally high-priced German periodicals.

E. D. MERRILL, *Director*
THE NEW YORK BOTANICAL GARDEN

GAUSS AND THE FRENCH ACADEMY OF SCIENCE

IN his "A Short Account of the History of Mathematics," 5th edition, p. 448 (1912), Ball makes the statement that Gauss had submitted a part of his famous Disquisitiones Arithmeticae to the French Academy, which the latter rejected in a manner which must have been humiliating for Gauss.

A careful examination of the writings and biographical material of Gauss does not show a trace for such an occurrence. Professor Brendel, of the University of Freiburg, who is in charge of the Gauss archive, does not know of anything that might point to such a rejection.

Moreover, according to an official transcript sent to the writer by Professor Picard, permanent secretary of the French Academy of Science, there is not

the slightest evidence that the academy ever did such a thing as Ball claims.

On the contrary, the academy bestowed upon Gauss at an early age the highest academic honors.

The record of the French Academy is clear and all in favor of Gauss.

ARNOLD EMCH

LEEUWENHOEK LETTERS

SOME American libraries and collections may possess letters written by and to Antony van Leeuwenhoek; and photographic copies of such letters are being sought by the Royal Academy of Sciences of Amsterdam, which is preparing a critical edition of Leeuwenhoek's correspondence. A list covering about 100 missing items is published in the appeal of Dr. G. van Rijnberk in *Nederl. Tijdsch. v. Geneeskunde*, December 1, 1934.

Readers knowing of such letters in America are asked to communicate the information to Dr. van Rijnberk, or to the undersigned.

BARNETT COHEN

JOHNS HOPKINS MEDICAL SCHOOL

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN EXTRACTOR USING A SOLUTION OF VOLATILE AND NON-VOLATILE PHASES

UNLIKE most extractors which are limited in their use to volatile solvents, a simple device is suggested which extracts with a solution consisting of one volatile phase and one or more non-volatile phases. Its success is due to the fact that if the vapor-disengagement area is sufficiently reduced, entrained solution is carried with the vapor.

A flask (Fig. 1) is filled with solution to a single

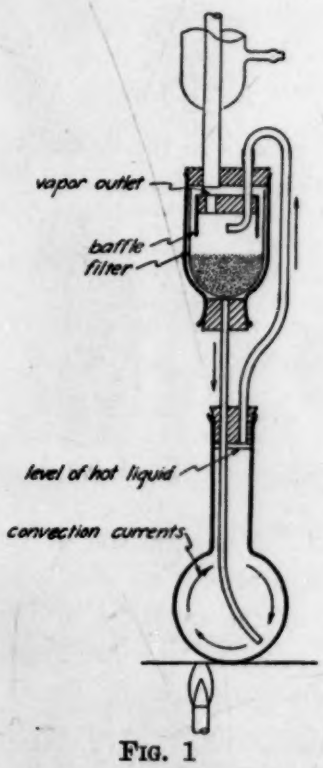

FIG. 1

small outlet. When boiled, vapor and solution are carried up to the filter. A baffle separates the vapor from the liquid. The return of the liquid through the filter to the bottom of the flask is facilitated by convection currents caused by heating the flask on one side.

The process is continuous and the velocity is controlled entirely by the amount of heat supplied. Larger quantities of liquid may be delivered to the filter than by condensate devices, since only a small part of the liquid has to be vaporized. This device may also extract by condensate alone by simply lowering the level of the liquid in the flask, thus increasing the disengagement area.

A. J. BAILEY

COLLEGE OF FORESTRY
UNIVERSITY OF WASHINGTON

A SIMPLE METHOD FOR OBSERVATION OF CIRCULATION IN THE WEB OF THE FROG'S FOOT

CIRCULATION of blood in the web of the frog's foot may be observed very clearly if the spread foot is strapped over the hole in the frog board with a strip of wet Cellophane secured to the board by thumb tacks (Fig. 1). The preparation is more quickly made than

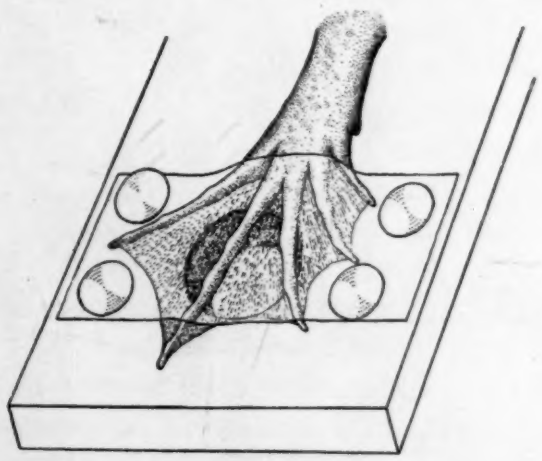

FIG. 1

are preparations in which the foot is spread by tying the toes, and is superior in a number of other respects. Since the animal is relatively comfortable, movements of the foot are reduced to a minimum. The web may be kept moist by occasional moistening of the Cellophane, or by introducing a film of water between the web and the Cellophane. Since the web is relatively flat, a good picture may be obtained with the 4 as well as with the 16 millimeter objective, without the use of

a cover glass. Preparations made thus may be kept under observation for a long time with little attention, except occasional moistening. With animals wrapped in the usual manner in wet cloth, preparations have been used in our laboratory for periods exceeding two hours. The method is so simple and obvious, the writer suspects that others must also have thought of it; but he makes bold to pass it on to those who may not have done so.

HORACE J. CHILD

SACRAMENTO JUNIOR COLLEGE

THE DESIRABILITY OF HOMOZYGOUS MICE IN NUTRITION EXPERIMENTS

IT is pretty generally conceded that the Wistar strain of rats is preferable in nutrition experiments, so that the animals will be homozygous and also of the same strain in coordinating the work of different investigators. Mice are used mainly by bacteriologists, cancer workers and geneticists, but in the assay of hormones and the determination of the nutritive value of pure chemical substances it is sometimes possible to save thousands of dollars by using mice instead of rats. Yet no standard strain of mice has been generally adopted. Since, however, a number of papers have appeared, using the Bagg strain of homozygous albino mice (Cold Spring Harbor Station of the Carnegie Institution), it seems probable that Table 1, showing the growth rate (mean body weight and standard deviation) of Bagg albinos, quoted from our paper in "Science Reports of Tohoku Imperial University," April, 1935, should be of interest. A paper on the growth and chemical composition of the brain of Bagg albinos by Hideo Endo will also appear in the same reports at a later date. Although the mouse grows at a slower rate we have been able to produce marked rickets in the mouse on the same diet that produced rickets in the rat.

TABLE 1

BODY WEIGHTS AND STANDARD DEVIATIONS IN GRAMS

Day of age	Males		Females	
	Mean weight	S.D.	Mean weight	S.D.
1	1.313	.200	1.300	.200
2	1.506	.245	1.515	.200
3	1.754	.283	1.770	.316
4	2.090	.374	2.160	.316
5	2.452	.458	2.570	.436
6	2.880	.548	3.020	.557
7	3.300	.574	3.470	.781
8	3.770	.663	3.970	.761
9	4.205	.768	4.425	.894
10	4.670	.774	4.920	.974
11	5.020	.948	5.320	1.118
12	5.390	1.128	5.630	1.288
13	5.775	1.162	6.040	1.331
14	6.100	1.162	6.410	1.414
15	6.407	1.200	6.690	1.536
16	6.570	1.049	6.920	1.477
17	6.780	1.183	7.040	1.550
18	6.850	1.483	7.170	1.517
19	6.960	1.442	7.240	1.637
20	7.130	1.466	7.410	1.674
21	7.330	1.449	7.720	1.612
22	7.669	1.634	7.950	1.761
29	9.480	1.803	9.870	1.897
36	12.360	2.345	12.500	2.290
43	14.740	2.236	14.470	2.190
50	16.740	2.510	15.610	2.388
57	18.540	2.934	16.640	2.367

J. F. MCCLENDON
HAROLD STREET

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SPECIAL ARTICLES

COMPARISON OF X-RAY AND GAMMA RAY DOSAGE[1]

NEED for a suitable correlation between x-ray and radium dosage had led us to extend our recent studies in the ionization produced in liquids by x-rays.[2] This note is for the purpose of giving briefly the results of some absolute measurements of the ionization produced in carbon bisulfide by gamma rays. Air ionization methods, while satisfactory for dosage measurements up to 200 kv, may be rendered ambiguous for higher frequency radiations because of lack of radiation equilibrium. A comparison of the physiological effects of different radiations ideally should be based on comparison of the numbers of ions produced in the tissue. In practice, one can make relative measurements in dielectric liquids nearly equivalent in density and atomic number to living tissue.

For gamma rays carbon disulfide is sufficiently near tissue (or wax) in atomic number and density to be considered equivalent. A combination of the two materials will, therefore, give an effectively homogeneous medium in which there will be radiation equilibrium and uniform mass absorption. Measurements were made of the gamma ray absorption in a layer 1 mm thick at the incident surface of a 25 cm cubical wax phantom. The ionization chamber con-

[1] Publication approved by the director of the National Bureau of Standards of the U. S. Department of Commerce.

[2] F. L. Mohler and L. S. Taylor, *Bureau of Standards Jour. Res.*, 13: 659, 1934.

sisted of two fine aluminum grids separated by a quartz disk 1 mm thick which had a 19 mm hole in the center. This was immersed in the liquid contained in a thin shallow glass dish which was in turn set into the wax surface. Fields up to 70,000 volts per cm showed that the "effective volume" was given by the geometric volume between the grids for separations from 0.5 to 2.5 mm. The radium, contained in a glass tube 8 mm long and .27 mm thick, was supported about 16 mm above the liquid surface and filtered with .75 mm brass plus 2 mm of bakelite. Applying approximate corrections for distance and filtration, the ionization produced by 1 mg of radium filtered with 1 mm of lead and at a distance of 1 cm from the wax surface was found to be 9400 e.s.u./cm³/hr. Assuming that the gamma ray absorption is proportional to the density of the liquid or gas and that the energy per ion pair is 24 electron volts as compared with 33 for air,[2] the above ionization would correspond to 6.9 roentgens per hour. Measurements made with the cell removed from the wax phantom showed the ionization to be almost entirely due to primary radiation. Similar measurements of the ionization produced in a mixture of CS_2 and ligroin (density = 1) by x-rays of equal doses generated at 120 kv and filtered with about .2 mm of copper gave an increase of about 30 per cent. due to back scattering as compared with 38 per cent. using a thimble ionization chamber calibrated in the usual manner. Since it is impossible to calibrate a thimble chamber for the radiation quality produced in the back scattering, the disagreement between the air and liquid measurements is not unexpected. Measurements made as here described in suitable liquids are independent of the radiation quality and hence the chambers need no calibration. While the above method seems well adapted to evaluating radium dosage in roentgens, the preliminary values given above are being investigated further in an endeavor to minimize the corrections.

LAURISTON S. TAYLOR
F. L. MOHLER

DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

TRANSMISSION OF THE VIRUS OF POLIOMYELITIS TO MICE

THE purpose of this paper is to report the successful propagation and serial transmission of the virus of poliomyelitis in mice. The mouse was chosen for this study for reasons described by one of us.[1]

Three series of mice were exposed to short repeated doses of x-ray and then inoculated, both intracerebrally and intraperitoneally, with suspensions of the spinal cords of monkeys, who had succumbed to poliomyelitis. In the first series, the animals were irradiated daily for 10 days prior to inoculation. On the second day after inoculation, x-ray treatments were begun again and were given daily for 8 days. On the eleventh day after injection, all the mice showed ruffled hair, sluggishness and dragged their hind legs, either on that day or the following one. Four of the animals died on the eleventh day, one on the twelfth, three on the sixteenth and three on the seventeenth day after inoculation. Two were autopsied on the eleventh and twelfth days. A suspension of their brains, when inoculated into mice and a monkey, failed to produce reaction.

In the second series, on the eleventh and twelfth day after inoculation they showed ruffled hair, ataxia, sluggishness and dragged their hind limbs. The animals in this group died or were killed. A suspension of their brains produced similar symptoms after an incubation period of from 14 to 24 days, in 5 out of 8 untreated mice, which were injected. A monkey inoculated with this suspension showed a rise in temperature. Serial passages were carried out, using mouse brains as the inoculum. Thus far, the virus has been maintained through 17 generations. With succeeding passages, the animal response became more definite and the incubation period became shorter; so that by the fifth passage, a 10 per cent. suspension brought down all the animals after an incubation period of 3 days. Using more concentrated brain suspensions, the incubation period may be shortened to 2 days, and with diluted suspensions it may be lengthened to 7 days. By successive transfer, the infectivity of the virus has been increased, so that by the twelfth passage it was infectious in a dilution of 1:1000.

In the third group, 4 out of 7 mice, inoculated with the brain material of irradiated mice that had succumbed, showed symptoms similar to those of the mice in the second series. Fifty control animals that were exposed to x-ray, but were not injected, developed no symptoms, although some of them received twice as many x-ray treatments as did the inoculated mice. When the filtrate of the suspension of the brains of 2 of the animals that came down with the aforementioned symptoms was injected into 8 untreated mice, 7 of them showed the usual hyperirritability, ataxia, sluggishness, ruffled hair and humped back. A monkey, inoculated with this filtrate, ran a typical course of poliomyelitis, with a characteristic histopathological picture in the cord. In the next passage, all twelve mice injected showed symptoms after an incubation period of 3 to 4 days. This series has undergone 14 transfers with changes of infectivity and incubation period, similar to those of the preceding series.

[1] M. Brodie, *Proc. Soc. Exp. Biol. and Med.*, March, 1935.

Now that the virus is fixed, the clinical picture in the mouse is quite acute. It begins with irritability, jumpiness, ruffled hair and goes on to ataxia, humped back, convulsions, circular movements, twisting of the head and sometimes ptosis of the eyelids. The animals usually die within a few hours after the onset of symptoms. The mice also can be infected by the intranasal route with an incubation period of 5 to 6 days.

In contradiction to the lesions in human and monkey poliomyelitis, those in the mice occur mainly in the brain and meninges, rather than in the spinal cord. In the pia-arachnoid and its projections there is an extensive mononuclear infiltration, mostly perivascular, which is most marked over the brain. In the spinal cord and brain stem, there is an occasional perivascular collar and some hemorrhagic foci; the cerebellum shows no changes; while the cerebrum shows perivascular collars, areas of hemorrhage, focal areas of necrosis and glia reaction with a rare polymorphonuclear leucocyte.

As in the monkey, the virus appears to be in the cerebro-spinal axis only. It is present in the cerebrum, brain stem, cord and cerebellum. The greatest concentration of the virus is in the cerebrum, which is in keeping with the distribution of the histopathological changes.

The following findings indicate that we are dealing with poliomyelitis and not a spontaneous virus infection of mice.

(1) The mouse virus was transferred to 13 monkeys and was infective in a dilution of 1:5000. A transfer of the virus from one of these monkeys to another monkey and back again to mice was successful. A complete histopathological study of the cords of four of these monkeys showed changes typical of acute anterior poliomyelitis.

(2) The serums of convalescent humans and monkeys, of actively immunized children and the serum of a so-called normal adult, containing anti-viral substance, neutralized this virus. Normal monkey serums failed to do so. Human convalescent serum protected a monkey against the virus and neutralized suspensions of cords removed from monkeys infected with the mouse virus. Upon diluting the serums, it was possible to obtain an end point in keeping with similar tests carried out in monkeys.

(3) Poliomyelitis in mice differs both clinically and histopathologically from the spontaneous mouse encephalomyelitis described by Theiler,[2] who kindly sent us some of his virus. The infectivity of the latter is irregular and its injection is followed by an incubation period of from 3 to 4 weeks. This spontaneous disease in mice runs a more protracted course with slowly progressing paralysis. The distribution of the virus in the cerebrospinal axis and the histopathological picture are also different from that of the mouse poliomyelitis.

One of us[3] has described the immunization of monkeys and children against poliomyelitis. However, the incidence of the disease is so low and the preparation of the vaccine so expensive that its application is limited. It has been found that not only convalescents, but also many normal children, even in the susceptible age group, have antiviral substances in their blood. Vaccination should be limited to those without any antibody. At present a test for antibody can be carried out only in monkeys. Results of preliminary experiments, in that they check with those of identical tests in the monkey, indicate that such a test can be carried out in the mouse. Thus it may be possible to use mice instead of monkeys to determine those who require vaccination and the results of the immunization.

In the mouse, the disease differs from that in the monkey, since in the smaller animal it is a meningo encephalomyelitis. The virus has lost its affinity for nerve cells, for it affects mainly the connective tissue elements of the central nervous system.

We believe that the outcome of the foregoing studies show that the virus of poliomyelitis has been transmitted successfully through mice by serial passage.

MAURICE BRODIE
SAMUEL A. GOLDBERG
PHYLLIS STANLEY

UNIVERSITY AND BELLEVUE HOSPITAL MEDICAL SCHOOL, AND PRESBYTERIAN HOSPITAL, NEWARK, N. J.

[2] M. Theiler, SCIENCE, 80: 122, 1934.

[3] M. Brodie, *Jour. Immun.*, 28: 1, 1935; *Am. Jour. Pub. Health*, 25: 1, 1933.

BOOKS RECEIVED

BLACKWELL, C. P. *Applying Science to Agriculture.* Pp. 318. 42 figures. Agricultural Experiment Station of the Oklahoma A. and M. College.

CHAMBERLAIN, CHARLES J. *Gymnosperms: Structure and Evolution.* Pp. xi + 484. 396 figures. University of Chicago Press. $4.50.

DIRAC, P. A. M. *The Principles of Quantum Mechanics.* Second edition. Pp. xi + 300. Oxford University Press. $6.00.

LIEBEN, FRITZ. *Geschichte der Physiologischen Chemie.* Pp. x + 743. Franz Deuticke, Leipzig. M 23.

MARSH, J. S. *Principles of Phase Diagrams.* Pp. xv + 193. 180 figures. McGraw-Hill. $3.00.

MORROW, CLARENCE A. *Biochemical Laboratory Methods for Students of the Biological Sciences.* Revised and rewritten by WILLIAM M. SANDSTROM. Pp. xv + 319. 37 figures. Wiley. $3.75.

POMFRET, JOHN E. *The Geographic Pattern of Mankind.* Pp. xv + 428. 15 figures. 21 plates. Appleton-Century. $4.00.